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president of the American Security and Trust Company, Washington, D. C., is the treasurer and General Calvin De Witt, 1707 21st Street, Washington, will gladly supply literature.

G. M. K.

GEORGETOWN UNIVERSITY,  
February 15, 1906.

#### SPECIAL ARTICLES.

##### RESULTS OF A REPLANTATION OF THE THIGH.<sup>1</sup>

IT has previously been shown that a satisfactory circulation may be established in a re-planted thigh.<sup>2</sup>

We wish here to record a summary of observations made on a similar experiment extending over a longer post-operative period.

The animal employed was a small white bitch. Through a longitudinal incision the vessels of the thigh were exposed and cut above the point of Scarpa's triangle. The skin was circularly severed and the thigh completely amputated above the junction of its lower and middle third. After a few minutes the limb was replanted. The ends of the bone, the muscles, the vessels and the sciatic nerve were united. The circulation was re-established after having been interrupted for one and one quarter hours. The pulsations of the popliteal and 'saphenous' arteries were normal. The dark blood circulated very actively through the femoral and saphenous veins. Red blood flowed from the small arteries of the peripheral part of the cut limb. The skin was sutured and a plaster dressing applied to the limb and trunk.

After the operation the general and local conditions of the animal remained very satisfactory. It drank and ate normally and walked on its three sound limbs. The skin of the replanted foot remained normal, but its hue was redder and its temperature higher than that of the normal foot. The anterior part of the foot soon became moderately swollen.

Seven days after the operation the dressing was partially removed. The limb presented

neither oedema nor trophic troubles. The oedema of the anterior part of the foot was doubtlessly due to pressure by the lower edge of the bandage, as the swelling completely disappeared within a few hours after correcting the fault of the dressing. The skin was normal and the wound had united 'per primam intentionem' without evidence of inflammation. The temperature of the skin was higher below than above the line of suturing.

Eight days after the operation the foot appeared normal in size, all oedema having disappeared.

On the tenth day, during the afternoon, the temperature of the replanted foot became lower, *i. e.*, similar to that of the normal foot. The dressing was then removed. It was found that, owing to a slipping of the plaster bandage, some urine had got into the cotton dressing and caused infection of the upper part of the longitudinal incision. A small subcutaneous abscess had developed, along the vessels. The general conditions of the animal were excellent, and the nutrition of the limb satisfactory. As the arterial pulsations were much weakened and as it was considered important to accurately determine the cause of this change, the animal was etherized and the vessels examined through cutaneous incisions, after which the animal was killed.

This dissection 'in vivo' gave the following results: The point of the vascular anastomoses was surrounded by the small subcutaneous abscess. The venous anastomosis was good. The arterial anastomosis was partially occluded by a small clot. All the other portions of the vessels appeared perfectly normal. The circulation through the limb was yet satisfactory, as the obliteration of the anastomosis was not complete. The union of the skin, the muscles and the sciatic nerve was normal. The process of consolidation of the bone was beginning. It is probable, but not certain, that if the animal had been allowed to live, the arterial stenosis would have gradually increased and that in the end the circulation would have been interrupted. Then, no doubt, gangrene of the limb would have occurred, which result would have been due

<sup>1</sup> From the Hull Physiological Laboratory, University of Chicago.

<sup>2</sup> Carrel and Guthrie, 'Complete Amputation of the Thigh with Replantation,' *The American Journal of the Medical Sciences*, February, 1906.

primarily to the secondary infection of the skin. This shows that in such experiments asepsis must be rigidly observed, not only during the operation but during all the post-operative period.

*Conclusions.*—(1) The circulation of a re-planted limb, reestablished an hour and a quarter after interruption, by end-to-end anastomosis of the femoral artery and vein, is normal, as judged by the metabolism of the limb. (2) No trophic trouble occurs (at least during ten days). (3) Healing of the severed tissues appears to be as rapid and complete as after an ordinary surgical wound.

ALEXIS CARREL,  
C. C. GUTHRIE.

SUCCESSFUL TRANSPLANTATION OF BOTH KIDNEYS  
FROM A DOG INTO A BITCH WITH REMOVAL OF  
BOTH NORMAL KIDNEYS FROM THE LATTER.

THIS operation was performed by our new method of *transplantation in mass*, which yields good results in the transplantation of organs. By this method the organs are permitted to retain their normal connections with a portion of their nervous apparatus, in such a manner that after transplantation their functions are soon reestablished.

A large-sized terrier was anesthetized and both kidneys and the upper part of the ureters were removed, together with their vessels, nerves, nervous ganglia, the surrounding connective tissue, the suprarenal glands, the peritoneum and the corresponding segments of the aorta and vena cava. The mass was then placed in a vessel of isotonic sodium chloride solution, and the dog killed.

A small young bitch was then anesthetized and the abdomen opened through a half circular transversal laparotomy. The aorta and vena cava were cut a little above the mouth of the ovarian vessels. The kidneys of the dog were then removed from the salt solution and put into the abdominal cavity of the bitch, and the segments of the aorta and vena cava were interposed, by biterminal transplantation, between the cut ends of the aorta and vena cava of the bitch. The circulation was re-established, after having been interrupted for one hour and a half. The kidneys imme-

dately became red and turgid, as after a simple transplantation, but about half an hour later the state of the circulation became normal, so that no difference could be detected between the transplanted and the normal kidneys. Clear urine flowed abundantly from the transplanted ureters, which were united to the normal ones.

Both normal kidneys were dissected and extirpated. The appearance of the transplanted and normal organs is so similar that in extirpating the latter, it is necessary to examine the pedicle in order to be certain of their identity. The operation was completed by suturing the abdominal wall and applying the dressing. Two hours after the operation the animal walked about her cage. In the afternoon she drank and urinated copiously. The following day and subsequently, up to the present time, her diet has largely consisted of meat. She drinks, eats, walks and, when permitted to, mingles with other dogs, but in the latter case she is carefully watched, as she shows a strong disposition to fight. As far as can be detected, her condition is normal. The urine has been clear throughout, showing no evidence of containing blood. The total amount appears to be somewhat increased. On the seventh and eighth days several samples were collected and analyzed, the results of which showed a slight variation in composition, but entirely within normal limits. The only abnormal constituent detected was coagulated proteid, the largest amount present in any of the samples being less than 0.25 per cent. A brief result of the analyses is given below:

Urine collected on the eighth day after the operation.

Color—pale yellow.

Odor—normal.

Reaction—slightly alkaline.

Urea—1.95 per cent.

Uric acid—trace.

Chlorides, sulphates and earthy and alkaline phosphates, normal.

Kreatinin, doubtful; indoxyl, none.

Coagulable proteid, less than 0.25 per cent.

Sugar and petone, none.

It was inconvenient to collect the total urine